

Claims

- [c1] 1. A cryogenic fuel tank assembly comprising:
a cryogenic fuel tank wall;
a foam assembly affixed to said cryogenic fuel tank wall,
said foam assembly having an inner surface and an outer
surface;
a first solid film bonded to said outer surface to provide
a uniform outer bonding surface; and
a thermal protection system assembly bonded to said
uniform outer bonding surface.
- [c2] 2. A cryogenic fuel tank assembly as described in claim
1, wherein said foam assembly comprises a polyimide
foam layer.
- [c3] 3. A cryogenic fuel tank assembly as described in claim
2, wherein said foam assembly further comprises a
polyurethane foam layer applied inboard of said poly-
imide foam later.
- [c4] 4. A cryogenic fuel tank assembly as described in claim
1, wherein said foam assembly comprises a polyurethane
foam layer.

- [c5] 5. A cryogenic fuel tank assembly as described in claim 1, further comprising:
a honeycomb core positioned within said foam assembly.
- [c6] 6. A cryogenic fuel tank assembly as described in claim 1, further comprising:
a silicon adhesive layer bonding said thermal protection system to said first solid film.
- [c7] 7. A cryogenic fuel tank assembly as described in claim 1, further comprising:
a polyurethane adhesive layer bonding said foam assembly to said cryogenic fuel tank wall.
- [c8] 8. A cryogenic fuel tank assembly as described in claim 1, further comprising:
a second solid film layer bonded to said inner surface to provide a uniform inner bonding surface, said uniform inner bonding surface bonded to said cryogenic tank wall.
- [c9] 9. A cryogenic fuel tank assembly as described in claim 1, wherein said uniform outer bonding surface further comprises:
a first fabric layer applied to said first solid film, said first fabric layer improving impact resistance of said cryogenic fuel tank wall.

- [c10] 10. A cryogenic fuel tank assembly as described in claim 9, wherein said first fabric layer comprises a glass fabric.
- [c11] 11. A reusable launch vehicle assembly comprising:
a cryogenic fuel tank including at least one cryogenic fuel tank wall;
a foam assembly affixed to said cryogenic fuel tank wall, said foam assembly having an inner surface and an outer surface;
a honeycomb core positioned within said foam assembly;
a first solid film bonded to said outer surface to provide a uniform outer bonding surface; and
a thermal protection system assembly bonded to said uniform outer bonding surface.
- [c12] 12. A reusable launch vehicle assembly as described in claim 11, further comprising:
a first fabric layer applied to said first solid film, said first fabric layer improving impact resistance of said cryogenic fuel tank wall.
- [c13] 13. A reusable launch vehicle assembly as described in claim 11, further comprising:
a second solid film bonded to said inner surface to provide a uniform inner bonding surface, said uniform inner bonding surface bonded to said cryogenic tank wall.

- [c14] 14. A reusable launch vehicle assembly as described in claim 13, further comprising:
a second fabric layer applied to said second solid film,
said second fabric layer improving impact resistance of
said cryogenic fuel tank wall.
- [c15] 15. A thermally protected fuel tank assembly comprising:
a fuel tank wall;
a foam assembly affixed to said fuel tank wall, said foam
assembly having an inner surface and an outer surface;
a first fabric layer bonded to said outer surface to pro-
vide a uniform outer bonding surface; and
a thermal protection system assembly bonded to said
uniform outer bonding surface.
- [c16] 16. A thermally protected fuel tank assembly as de-
scribed in claim 15, wherein said foam assembly com-
prises a polyimide foam layer.
- [c17] 17. A thermally protected fuel tank assembly as de-
scribed in claim 16, wherein said foam assembly further
comprises a polyurethane foam layer applied inboard of
said polyimide foam later.
- [c18] 18. A thermally protected fuel tank assembly as de-
scribed in claim 15, further comprising:
a honeycomb core positioned within said foam assembly.

- [c19] 19. A thermally protected fuel tank assembly as described in claim 15, further comprising:
a silicon adhesive layer bonding said thermal protection system to said first fabric layer.
- [c20] 20. A thermally protected fuel tank assembly as described in claim 15, further comprising:
a second fabric layer bonded to said inner surface to provide a uniform inner bonding surface, said uniform inner bonding surface bonded to said cryogenic tank wall.
- [c21] 21. A thermally protected fuel tank assembly as described in claim 15, wherein said uniform outer bonding surface further comprises:
a first solid film applied to said first fabric layer.
- [c22] 22. A thermally protected fuel tank assembly as described in claim 20, wherein said uniform outer bonding surface further comprises:
a second solid film applied to said second fabric layer.
- [c23] 23. A method of insulating a fuel tank comprising:
applying a foam assembly to a fuel tank wall, said foam assembly having an inner surface and an outer surface;
generating a uniform outer bonding surface on said outer surface by bonding a first solid film to said outer

surface;

bonding a thermal protection system onto said uniform outer bonding surface.

[c24] 24. A method of insulating a fuel tank as described in claim 23, wherein said foam assembly is produced by: filling a honeycomb core with an uncured foam material; applying said first solid film to said outer surface, said first solid film engaging said honeycomb core; and curing said uncured foam material and said first solid film simultaneously such that said uniform outer bonding surface is generated.

[c25] 25. A method of insulating a fuel tank as described in claim 23, further comprising: generating a uniform inner bonding surface on said inner surface by bonding a second solid film to said inner surface, said uniform inner bonding surface generated prior to said applying a foam assembly to said fuel tank wall.

[c26] 26. A method of insulating a fuel tank as described in claim 23, further comprising: applying a first fabric layer to said first solid film prior to bonding said first solid film to said outer surface.

[c27] 27. A method of insulating a fuel tank as described in

claim 25, further comprising:

applying a second fabric layer to said second solid film prior to bonding said second solid film to said inner surface.